

# Executive Summary

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Over the last 10 years, WSDOT's efforts to improve highway safety have included engineering to help drivers keep their cars on the road and to lessen the safety consequences when they fail to do so. We have installed rumble strips, improved and straightened curves, widened highway shoulders, improved medians and installed median barriers.

In Snohomish County, for example, when State Route 525 in Lynnwood and State Route 522 near Maltby were rebuilt, medians and median barriers were installed on the new divided highways. We installed rumble strips on I-5 throughout Snohomish County. We installed raised medians on urban arterials, including State Route 525 in Mukilteo and State Route 527 in Mill Creek. Our efforts to help keep drivers on highways produced dramatic results. From 2002 through 2004, fatal highway collisions in Snohomish County decreased over 50 percent and fatal head-on collisions dropped 75 percent.

Despite the good results produced across the county, the public raised significant concerns about I-5 in Marysville resulting from the increasing number of crashes and the large number of crossover collisions. As a result, WSDOT conducted a comprehensive review of traffic safety on I-5 through Marysville.

From 1999 through 2004, the Washington State Patrol received reports of 171 collisions where vehicles left the road and hit cable median barrier on I-5 in Marysville. In total 13 of these collisions involved vehicles that crossed the median into opposing lanes of traffic. This means that cable barrier on I-5 in Marysville is catching 92.4 percent of errant vehicles that hit the barrier, which is somewhat lower than the 95 percent average for performance of cable barrier on highway segments elsewhere in the state.

The purpose of this study is to examine the collisions that went through cable median barrier on I-5 in Marysville, so we include the five vehicles that crossed through cable median barrier in 2005, making a total of eighteen through cable barrier incidents examined in this report. However, most other 2005 collision and traffic data is not yet available. As a result, some parts of this report must rely on data from 1999 through 2004.

## **1 Why do more vehicles cross the freeway median on I-5 in Marysville than elsewhere in the state?**

### **Cars lifting cable barrier**

Our research revealed that 15 of 18 (83%) vehicles that crossed the median on I-5 in Marysville from 1999 through 2005 were traveling in the southbound direction. This was even more notable because southbound vehicles in this area comprised only 46 percent of all cable rail collisions between 1999 through 2004. All three crossover collisions that resulted in fatalities involved southbound vehicles. This led us to focus our research on southbound crossover collisions.

When we examined the 15 southbound crossover collisions, we found that 11 involved sedans. This led us to focus our research on collisions involving sedans.

We then examined the locations where southbound sedans crossed the median. We found that these crossover collisions occurred where the cable barrier was placed within five feet of the bottom of the ditch on the slope nearest the northbound lanes, that is, on the opposite side of the ditch from the southbound lanes.

**Exhibit 0-1**  
**Car Lifting Cable Barrier**



*This photo, from a 2004 Federal Highway Administration crash test, shows how the front tires of a sedan compress after hitting the bottom of a ditch. This allows the bumper of the car to nudge under the lowest barrier cable.*



*As the vehicle continues forward it lifts the cable median barrier and continues up the slope, while the cables pass over the top of the vehicle.*

This data along with accident and maintenance reports, overwhelmingly suggest that southbound sedans ran into the median and bottomed out in the ditch. This compressed the cars' front tires, which left their front bumpers low enough to nudge beneath the lowest cable on the barrier. Then as momentum carried the cars up the slope, they lifted the cable median barrier and continued across the median as the cables passed over the top of the vehicle. This accounts for a preponderance of the cross-median collisions near Marysville.

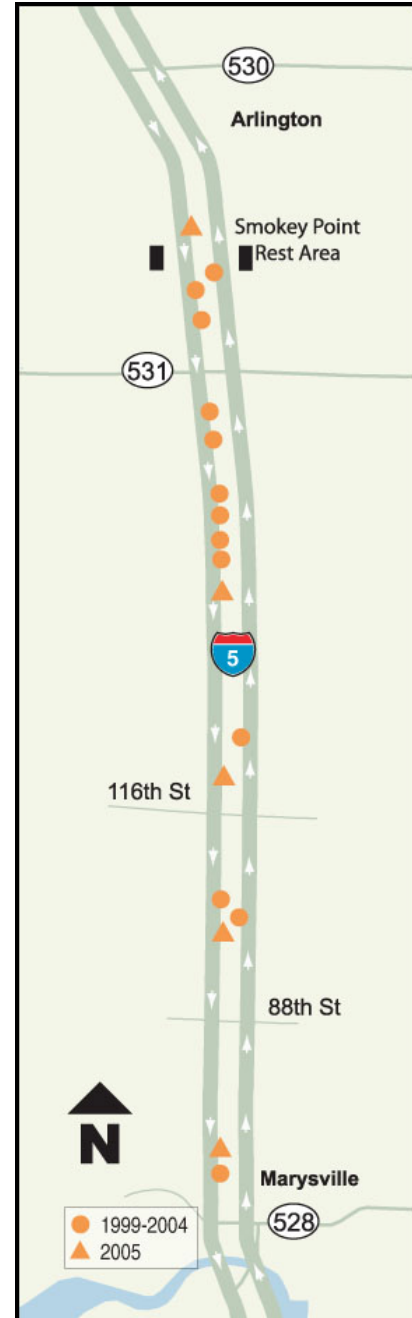
### Mix of high speeds and congestion

At least three collisions between 1999 and 2004 involved vehicles that hit the cable barrier with such great force that the barrier flexed more than desired. This indicates that the vehicles were traveling at high speeds or high angles as they struck the barrier. The cable barrier is designed to flex to absorb some of the force of impact while still keeping the vehicle within the median. In these three instances the barrier reduced the momentum of the errant vehicle, which still entered oncoming traffic lanes.

In 2004, an average of 62 drivers per day exceeded 90 mph on I-5, north of the Smokey Point Rest Area. This was one of the places in the state where drivers most frequently traveled at speeds greater than 90 mph. While the percentage of drivers traveling at these high speeds is very small, data indicates that a high number of motorists are driving recklessly. Other drivers on I-5 in Marysville were speeding, too. Fourteen percent of southbound drivers and 20 percent of northbound drivers were traveling at 75 mph or faster, while the speed limit remained 70 mph through June 30, 2005.

Southbound I-5 drivers travel from free-flowing traffic at high speeds to an urban setting with traffic congestion starting at State Route 531. Some drivers abruptly slow down as they approach slower moving traffic or weave through traffic at high speeds. Drivers that travel in this manner have a higher risk of collisions and leaving the road.

**Exhibit 0-2**  
**I-5 Marysville Cross**  
**Median Crashes**



## **2 How does WSDOT plan to address cross median collisions in Marysville?**

### **Install a second run of cable median barrier**

In 2006, WSDOT will install a second run of cable barrier in the I-5 median in Marysville. We believe that placing barrier on both sides of the median ditch will address vehicles bottoming out in the ditch and lifting the cable barrier. Design is underway and we expect to install the new barrier in 2006.

WSDOT engineers considered installing concrete barrier or guardrail, but they determined that these more rigid barriers would likely increase the number and severity of crashes in this location.

### **Reduced speed limits and speed limit enforcement**

In 2005, WSDOT reduced speed limits from 70 mph to 60 mph on the most congested part of I-5 through Marysville.

Washington State Patrol troopers have been conducting emphasis patrols to enforce the new speed limit.

These efforts are making a difference. During the second quarter of 2005, with a 70 mph speed limit, 18.4 percent of all drivers traveled above 75 mph. During the third quarter of 2005, after the speed limit was lowered to 60 mph, 13.2 percent of all drivers traveled above 75 mph. In addition, the number of drivers traveling at speeds above 90 mph near the Smokey Point rest area dropped 20.5 percent, from an average of 78 drivers per day to 62 drivers per day during the six-month study period.

The Washington State Patrol plans to continue it's efforts to enforce speed limits in this area.

### **3 Does WSDOT plan to continue to use cable barrier?**

Yes, because cable median barrier reduces the risk of injuries and fatalities and reduces the severity of injuries when vehicles travel into the median. For each potential installation location WSDOT engineers assess which type of median barrier will best reduce the risk of injury to drivers; whether the barrier should be cable, beam guardrail or concrete. They consider a variety of factors, including safety, median width, traffic flow, environmental and community impacts, legal and regulatory compliance, cost, and other factors.

WSDOT engineers analyzed 11,457 median barrier collisions on Washington State highways from 1999 through 2004. Excluding I-5 in Marysville, where factors not present elsewhere are influencing cable barrier performance, occupants of vehicles striking cable barrier are less likely to be injured or killed than those striking concrete barrier or guardrail. This is partly because cable barrier is far less likely to redirect an errant vehicle into a second vehicle in the collision.

Statewide, cable barrier successfully restrained 95 percent of errant vehicles without involving a second vehicle. In comparison, only 67 to 75 percent of crashes with W-beam guardrail and concrete barrier successfully restrained errant vehicles without involving a second vehicle. This means vehicles striking concrete barrier and beam guardrail are more likely to involve a second vehicle in a collision. When one vehicle crashes into another during a collision, the risk of injury and the number of injuries increase.

National research conducted in spring 2004 brought to light the phenomenon of some sedans lifting the cable barrier when the barrier is placed between one and five feet from a ditch bottom. WSDOT responded quickly to this concern by issuing guidance that directed our engineers to avoid placing cable barrier within one to six feet from the bottom of a ditch on all new projects, pending a final recommendation on how to address this phenomenon. Our engineers continue to follow this guidance.